

### ABSTRACT

An ammonia synthesis process and apparatus are provided which are energy efficient and minimize greenhouse-gas-emission during the processing of natural gas and air. In the process a stream of natural gas is divided into two streams, one of which is  
5 mixed with air and ignited to provide heat for the thermal decomposition of natural gas into hydrogen and carbon and also to provide deoxygenated nitrogen for an ammonia synthesis process. The process essentially prepares hydrogen and nitrogen on a low average temperature side of a chemical reactor and then feeds both gases to the high average temperature side of the chemical reactor where they react to form ammonia. The  
10 formation of ammonia is exothermic, whereas the thermal decomposition of methane is endothermic and the combustion of methane to remove oxygen is also exothermic; the sum of the heats absorbed and released in these reactions is positive. Catalysts, high temperatures and pressure are used to promote the rapid formation of ammonia, as is standard practice in the chemical industry. Catalysts, and high temperatures are used to  
15 promote the thermal decomposition of natural gas and combustion of oxygen that provides hydrogen and nitrogen for ammonia synthesis.